Mobile Sources ETV Update

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Stakeholders Advisory Committee Meeting
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ETV for Mobile Sources Overview

- *Why?*
- *Scope*
- *ETV & EPA-EPA OTAQ Relationship*
- *Technologies, Status, & Activities*
  - *Devices*
  - *Fuels*
  - *SCR*

ETV for Mobile Sources

Why?

- *NOx, VOC, and PM are serious national problems*
- *Increasing recognition of relative importance of diesel engines*
- *Innovative technologies are needed and are being proposed and developed*
- *SIP credits available through the voluntary diesel retrofit program (VDRP)*

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Interest Level High

- *Technical Panel meetings have been well-attended and attracted good participation*
- *Attracting trade press attention and attendence*
- *Numerous meetings and conferences*
  - *CARB Diesel Retrofit Meetings and International Panel*
  - *DOE Conferences (DEER 2000, 2001)*
  - *Presenting papers on verification at Fleet Managers Association in April and Law Enforcement Fleet Association Meeting in August.*
  - *Planning paper for DEER 2002*
- *Numerous inquiries and applicants*

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Scope

- *Emissions control performance verification for air pollution control technologies for mobile sources*
  - *NOx, PM, HC, & CO are primary*
  - *Also CO_2, fuel, and other operating parameters*
- *Focus on retrofit controls for diesel engines*
  - *Highway and Non-road*
  - *Test based on Federal Test Procedures (FTPs) for engine certification*
  - *VDRP provides incentive to participate*

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- *Manages tests not conducted by engine manufacturers*
- *Prepares test/QA plan*
- *Audits ETV test labs*
- *Conducts ETV tests*
- *Issues ETV verification reports and statements*

VDRP (EPA)

- *Accepts emissions reductions data from ETV*
- *Evaluates total application package*
- *Sets VDRP credits for test engine(s)*
- *Extends applicability to other engines (and adds requirements for additional data)*

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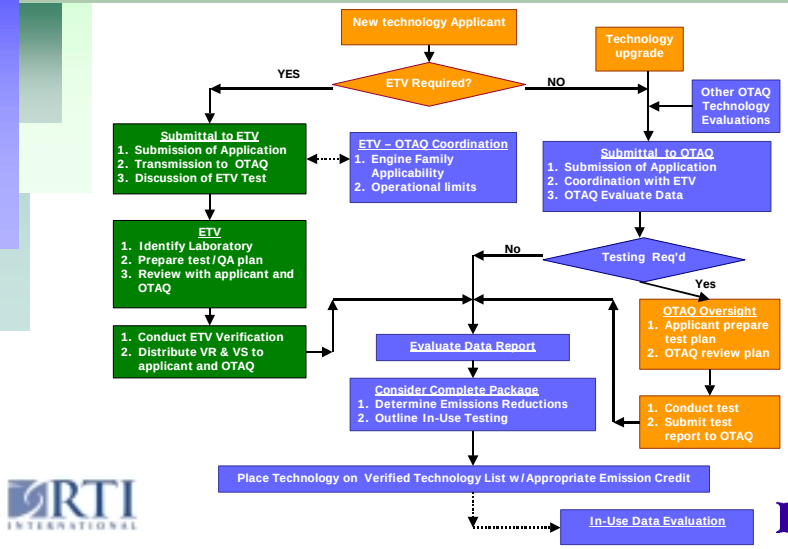
Verification Flow Chart



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Technology Groups

- *Devices*
  - *Diesel Exhaust Catalysts (DECs)*
  - *PM filters*
  - *Engine modifications*
  - *Other devices*
- *Fuels*
  - *Alternative fuels (emulsions, biodiesel)*
  - *Reformulations*
  - *Fuel additives*
  - *Lubricants and lubricant additives*
- *Selective Catalytic Reduction*

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Diesel Exhaust Catalysts

- *Catalyst oxidizes PM and unburned hydrocarbons*
- *Description:*
  - *Oxidation catalyst installed in the exhaust of a conventional or modified diesel*
  - *20-30% PM reductions, 50-80% HC reductions*
  - *Numerous formulations involving platinum, paladium, and rhodium, various processing steps, and supports*
- *Relatively large base of mobile source experience*
- *Has been combined with other technologies such as EGR, fuel-borne catalysts, and low-sulfur fuels*

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Diesel Particulate Filters

- *Mostly wall-flow filters with catalysts coated on the filter or fuel-borne. In-situ soot combustion, either continuously (more-or-less) or periodic*
- *>70% PM, >90% HC, 60% CO reductions demonstrated on mobile sources*
- *Occasional cleaning required for non-combustibles*
- *Has been used in combination with other technologies such as EGR, low sulfur fuels, NOx catalysts*

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Engine Modifications

- *Miscellaneous other devices*
  - *Wide range of low cost devices*
    - *– Inline fuel catalysts*
    - *– Magnetic devices*
    - *– Crankcase ventilation*
  - *Exhaust gas recirculation*
  - *Throttle controls*

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Devices GVP Posted

Revision No.: 07
Date: January 22, 2002

DRAFT

GENERIC VERIFICATION PROTOCOL FOR DIESEL EXHAUST CATALYSTS, PARTICULATE FILTERS, AND ENGINE MODIFICATION CONTROL TECHNOLOGIES FOR HIGHWAY AND NONROAD USE DIESEL ENGINES

EPA Cooperative Agreement No. CR826152-01-3
RTI Project No. 93U-7012-015

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Overview of Devices Protocol

- *Based on engine dynamometer FTPs*
  - *Minimum of 1 full FTP (cold- and hot-start test) and 2 additional hot starts on baseline engine and same engine with control device installed*
  - *Additional tests may be required*
- *Results reported as mean and 95% confidence interval of emission reduction for each pollutant*
  - *Statistics computed from multiple hot starts*
  - *If confidence interval includes zero reduction, then results published but no verification statement issued*
- *Test lab is Southwest Research Institute*

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Devices Activities

- *Devices ETV Technical Panel*
  - *First TP meeting was Nov. 8, 2000*
  - *Total of 8 TP meetings, mostly in Washington, DC*
  - *TP attendance and participation were good*
- *Draft Generic Verification Protocol published Jan. 2002 (Rev. 7)*
- *Developing test/QA plan template*

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Status of Devices ETV

- *Applications*
  - *Two diesel exhaust catalyst technologies (Donaldson and CleanAIR Systems)*
  - *Numerous small companies with various amounts and quality of data to back up performance claims*
    - *Devices: Clear Imaging Alterntives, Motormaster, Fuel Preporator, ENECON, Fuel Panther*
    - *Software throttle control: Mirenco*
  - *Cost is an issue for small companies*
- *Still formalizing coordination with EPA-OTAQ*
- *Expecting to begin ETV testing in mid-April, 2002*

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Fuels Technolgies

- *fuel additives*
- *fuel-borne catalysts*
- *Diesel fuel reformulations,*
- *Emulsions and biodiesel,*
- *Lubricants and lubricant additives*
- *Scope includes both diesel and gasoline fuels*

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Fuels ETV Overview

- *Taking same general approach as for devices*
- *Determine effect on emissions*
- *Additives require prior EPA approval*
- *May be combined with other technologies and verified as a system*

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Fuels ETV Issues

- *Engine manufacturers are cautious because of potential impacts through-out engine and fuel infrastructure*
- *Two general classes of technologies*
  - *Emissions effects that begin immediately*
  - *Emissions effects that begin after extended operating period*
- *Including gasoline introduces additional FTP tests and additional engines*
- *Harmonization with California*

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SCR Technology

- *Presently SCR is the only way to get high NOx reductions.*
- *But little experience with SCR on mobile sources*
- *System*
  - *Urea or ammonia injection into exhaust with SCR catalyst downstream. Generally requires low sulfur fuel*
  - *Parts (urea/ammonia tank, pump, control system, and catalyst(s) may be put together by a system integrator*
  - *Urea/ammonia injection controlled via look-up table developed for a specific engine and catalyst. The look-up table is not portable. Can be retrofit, but not a simple system*
- *Has been used in with DECs and/or PM filters*

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SCR ETV Overview

- *We are proposing the same basic test protocol as used for devices GVP*
- *Additional requirement for measurement of ammonia (or other reductant) slip*
- *Little operating experience and uncertainty is high regarding commercial operation*
- *Combination systems will be verified as systems*

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SCR Issues

- *For ETV and EPA:Harmonization w/ California*
- *For ETV*
  - *Defining a commercial-ready system and ensuring that it doesn't change excessively*
  - *Handling system sizing so performance is not overstated*
- *For EPA-OTAQ*
  - *Durability*
  - *Safety*
  - *Infrastructure*

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Fuels and SCR activities & schedule

- *Fuels GVP*
  - *First TP meeting was Feb. 27, 2002.*
  - *About 40 people present. Good progress.*
  - *Target to complete first draft by early April*
  - *Publish the protocol by the end of June, 2002.*
- *SCR GVP*
  - *First TP meeting was Feb. 28, 2002.*
  - *About 40 people present. Good progress.*
  - *Target to complete first draft by early April*
  - *Publish the protocol by the end of June, 2002.*

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